

International comparisons of productivity QMI

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Table of contents

1. [Methodology background](#)
2. [Overview](#)
3. [Executive summary](#)
4. [Output quality](#)
5. [About the output](#)
6. [How the output is created](#)
7. [Constructing results](#)
8. [Validation and quality assurance](#)
9. [Concepts and definitions](#)
10. [Other information](#)
11. [Sources for further information or advice](#)

1 . Methodology background

National Statistic	
Survey name	International Comparisons of Productivity
Frequency	Bi-annual
How compiled	Based on third party data
Geographic coverage	G7 countries
Last revised	20 July 2012

2 . Overview

- measures labour productivity estimates, which are defined as economic output per unit of labour input
- covers the G7 countries: Canada, France, Germany, Italy, Japan, the UK and the US
- data is mainly sourced from the Organisation for Economic Co-operation and Development (OECD)

The [International Comparisons of Productivity \(ICP\)](#) statistics present labour productivity estimates. The measures published include GDP per worker and GDP per hour worked. Hours worked amounts to the product of total employment and average hours actually worked.

Estimates are presented as levels, allowing comparisons between countries at a point in time, and as growth rates, for comparison through time.

Comparisons are made between the UK and the other member countries of the G7: Canada, France, Germany, Italy, Japan and the United States as well as aggregates for the G7 and the G7 excluding the UK.

With some minor exceptions, the source data are published by the [Organisation for Economic Co-operation and Development \(OECD\)](#), and as such, the ICP release schedule reflects that of the OECD publication cycles.

The statistics are used both within and outside government. In combination with other comparative economic indicators, they help build a more comprehensive picture of the UK economy relative to its competitors.

3 . Executive summary

This report relates to international comparisons of productivity (ICP) statistics, which can be found on the [productivity measures](#) webpage on the Office for National Statistics (ONS) website.

The publication considers labour productivity estimates, defined as economic output per unit of labour input. In line with this definition the measures published are gross domestic product (GDP) per worker and GDP per hour worked; where hours worked equals the product of total employment and [average hours actually worked](#). These measures can yield different results, reflecting different working patterns across countries and time. Comparisons are made between the UK and the other member countries of the G7: Canada, France, Germany, Italy, Japan and the United States as well as aggregates for the G7 and the G7 excluding the UK.

Responsibility for the statistics was transferred to ONS in 2001, as explained in [International comparisons of productivity - an update on developments](#). The statistics correspond to calendar years and are published twice a year. Each autumn the series are extended by a year; in the subsequent spring the release is updated to incorporate the latest data.

With some minor exceptions (see the How the output is created section) the source data are published by the [Organisation for Economic Co-operation and Development \(OECD\)](#). Therefore the ICP release schedule reflects the publication cycles of the OECD series: current and constant price GDP, [purchasing power parities \(PPP\)](#), employment and average hours actually worked.

Estimates are presented as both levels, allowing comparisons between countries at a point in time and growth rates, for comparison through time. For productivity levels, the value of economic output in local currency units is converted to a common currency, using PPP exchange rates for each year and then divided by the appropriate labour input. PPP convert the price of a representative basket of goods and services in different countries to the price in the US. Therefore, PPPs equalise the relative price levels across countries.

Synthetic estimates of productivity levels in the G7 and G7 excluding the UK are created by dividing the sum of GDP in common currency by the sum of labour input across the relevant countries. The resulting levels of productivity are indexed to UK equals 100 in each year.

For growth rates, productivity estimates for each country are computed in the conventional fashion, as volume measures of GDP per unit of labour input. These estimates are indexed to a common year to demonstrate relative movements in productivity over time for the range of countries. In addition, G7 aggregates are derived as follows:

- convert value measures of GDP in a base year to common currency using PPPs
- for each country, extrapolate the common currency measure of GDP forwards and backwards from the base year using the growth rate of the volume measure of GDP in that country
- sum the resulting series across countries for each year to obtain G7 estimates for GDP volumes in common currency terms
- divide by the sum of labour input and index to the same year as the individual country productivity estimates

The [ONS productivity handbook](#) provides comprehensive information on the ONS productivity framework and methodologies.

This report contains the following sections:

- Output quality
- About the output
- How the output is created
- Validation and quality assurance
- Concepts and definitions
- Other information, relating to quality trade-offs and user needs
- Sources for further information or advice

4 . Output quality

This report provides a range of information that describes the quality of the output and details any points that should be noted when using the output.

We have developed [Guidelines for Measuring Statistical Quality](#); these are based upon the five European Statistical System (ESS) Quality Dimensions. This report addresses these quality dimensions and other important quality characteristics, which are:

- relevance
- timeliness and punctuality
- coherence and comparability
- accuracy
- output quality trade-offs
- assessment of user needs and perceptions
- accessibility and clarity

More information is provided about these quality dimensions in the following sections.

5 . About the output

Relevance

(The degree to which statistical outputs meet users' needs.)

International comparisons of productivity (ICP) estimates are presented in a simple and intuitive manner. Levels of productivity in each country are presented relative to the UK, as well as internationally comparable growth measures for the most recent time period. The statistics are used by customers both within and outside government.

In combination with other comparative economic indicators, they help build a more comprehensive picture of the UK economy relative to its competitors. Identified users of the estimates include:

- Cabinet Office, HM Treasury, Department for Business, Energy and Industrial Strategy (BEIS) and other government departments – use the ICP release to place the progress of their productivity strategies for the UK in the context of other countries' performances; this is achieved through an assessment of the productivity gap between the UK and its principal competitors
- businesses – interested in understanding the implications of productivity trends for the international economic outlook, which in turn can influence economic policy; this can affect markets and competitors
- researchers and academics – often include productivity analysis in papers and presentations on the economic performance of the UK; ICP estimates can provide information assisting the development of economic theory and application
- the media – cite ICP estimates in the analysis of how policy and world events affect UK productivity both on its own, and relative to other countries, in the medium- and long-term
- the public – are interested in how the UK performs in terms of productivity as in the long-term this can affect economic welfare and well-being

The G7 countries are used for the geographical coverage as they represent principal trading partners and competitors, have economies similarly structured to our own and provide comparable data. For analysis of individual countries, national productivity data will often be the preferred source.

Timeliness and punctuality

(Timeliness refers to the lapse of time between publication and the period to which the data refer. Punctuality refers to the gap between planned and actual publication dates.)

The ICP release schedule reflects the publication and revision cycles of the OECD sources. The output (gross domestic product (GDP)) series are relatively timely whereas the labour input series are published only annually, during the summer months. Publication dates are based upon expectations of when the

OECD publishes the component series and therefore can change by up to several weeks between editions. Hence, the ICP estimates are normally published with the following lags:

- provisional annual results: 9 to 10 months after the reference period
- finalised annual results: 13 to 15 months after the reference period

For more details on related releases, the [GOV.UK release calendar](#) provides 12 months' advance notice of release dates. If there are any changes to the pre-announced release schedule, public attention will be drawn to the change and the reasons for the change will be explained fully at the same time, as set out in the [Code of Practice for Official Statistics](#).

6 . How the output is created

Data sources

Data sources for this bulletin are as follows: gross domestic product (GDP) from the [OECD Main economic indicators](#) (updated monthly), [purchasing power parity](#) estimates from the OECD (updated continuously), employment from the [OECD Annual labour force statistics](#) (updated annually) and average actual hours worked from [OECD Employment outlook](#) (updated annually). For more information on these sources see the Validation and quality assurance section.

Labour input measures

To ensure consistency, labour input measures are taken from the OECD's Annual labour force statistics and its Employment outlook, which in turn mostly gather their information from individual countries' Labour Force Surveys (LFS). However, in the specific case of UK total employment and hours, the measures are taken directly from the UK's own LFS (published as part of the [Labour market statistical bulletin](#)). This is because of UK population weight revisions that have not yet been incorporated into the data on the OECD statistical portal. For French total employment, an estimate from the [Eurostat LFS database](#) is used in the autumn bulletin, because the OECD version is not ready in time for the ICP release.

Output measures – GDP and PPP

The purchasing power parities (PPPs) used are derived from a joint programme between the OECD and Eurostat. By taking the US as the base country the PPPs for each year show how much a representative basket of goods and services, priced in US dollars costs in different countries in their domestic currencies. Therefore, PPPs adjust for the relative price levels across countries.

Note that the output measure used (GDP in market prices) differs from that in the [Labour productivity statistical bulletin](#) (gross value added (GVA) in basic prices, that is, net of indirect taxes and subsidies). There are two reasons for this: firstly, because PPPs are implicitly based on market prices rather than basic prices and secondly, because internationally comparable measures of GVA are not readily available.

For international comparisons of productivity, PPPs are preferred to market exchange rates, which fluctuate for reasons other than countries' relative price movements, such as interest-rate differentials and currency speculation. In addition, market exchange rates at best only reflect the relative price movements of the traded sector. In contrast, PPPs are constructed to cover the entire range of final goods and services, which make up the whole of GDP (expenditure) including many items, such as construction and government services, which are not traded internationally.

The output measure used in ICP-level calculations is current GDP adjusted using the PPPs for each year. Since this representative basket of goods and services changes over time, these estimates give the most accurate analysis of relative price structures in any given year. However, they should not be used for time series or growth analysis as the price structure can change between years.

To compare growth rates of productivity between countries, current GDP at purchasing power parity is calculated in a base year, reflecting the OECD's PPPs benchmark year, when the analysis of price structures will be most accurate. This is then extrapolated forward and backward by applying annual growth rates of real GDP for each country to produce additive measures of output in common currency for each year. This allows for analysis through time, as the price structure does not vary over time and so only volume changes are captured in the series. Using this approach is not necessary for calculating volume growth for any given country, but is necessary for calculating growth for the G7 group as a whole.

For more information on the use and application of PPPs, see [International comparisons of productivity: the current and constant PPP approach](#).

7 . Constructing results

The basic calculations are as the following equation (where i represents each country or group):

$$\text{GDP per worker}_i = \frac{\text{GDP}_i/\text{PPP}_i}{\text{Employment}_i}$$

$$\text{GDP per hour worked}_i = \frac{\text{GDP}_i/\text{PPP}_i}{\text{Employment}_i \times \text{AverageHours}_i}$$

Note that when calculating growth rate comparisons, the numerator refers to GDP at PPP in a base year (the OECD's benchmarking year), which has been extended forward and backward in time using volume growth rates of GDP.

Indexing

For ICP level comparisons, indices are calculated for each country and the G7 aggregates, demonstrating productivity performance relative to the UK. In each year the derived labour productivity measure for each country is divided by the UK estimate for that year and multiplied by 100. Numbers in excess of 100 indicate that productivity is higher in that country compared with the UK. Numbers below 100 indicate that productivity is higher in the UK.

For ICP growth comparisons, labour productivity estimates for all countries are indexed to 100 in 2004, enabling comparisons of productivity growth for any given year relative to this reference period. The year 2004 has been selected as the reference period as it corresponds with a low discrepancy between the UK and G7 productivity levels and allows clear comparison within the most recent periods.

8 . Validation and quality assurance

Accuracy

(The degree of closeness between an estimate and the true value.)

As a derived statistic, the accuracy of the international comparisons of productivity (ICP) estimates is determined by the accuracy of the sources. Owing to differences in concepts and measurement practices across countries, as explained in the Comparability and coherence section, the inputs might not be directly comparable. You should be aware of this measurement error. As a rule of thumb, differences between countries or time periods of less than 3 index points are not commented upon within the bulletin.

We have a comprehensive [Revisions Policy](#) for our outputs and revisions spreadsheets are included in each edition of the [ICP statistical bulletin](#), showing changes made to estimates between editions. Revisions to ICP estimates are made in line with revisions to the sources as follows.

Gross domestic product (GDP) data – there are regular revision cycles in the national accounts. Such revisions impact more on real (inflation-adjusted) estimates than on nominal estimates. Since countries' revision cycles do not always coincide and may vary from year to year, some minor country-specific ICP revisions originating from this source are expected in each release. These revisions mostly affect the latest years.

Purchasing power parities (PPPs) – ICP estimates are particularly sensitive to changes in PPPs, which have been the biggest source of revisions to level estimates. The OECD and Eurostat share the responsibility for compiling the PPPs. The major revision programme for 1995 to 2000 PPP data, together with the 3-year rolling annual benchmarking method, has meant that from 1995 onward there are smaller revisions within the European group as a whole, in relation to non-European countries. Consequently, there are larger revisions in ICP for the non-European countries (that is, the US, Canada and Japan) following the release of triennial benchmark results for PPPs.

Employment data – revisions to employment series normally only occur in the autumn release; the main exception is benchmarking to census results, which leads to one-off employment revisions. This tends to happen once in 5 or 10 years depending on the frequency of a country's census. Among the G7 countries, France revises its numbers most often. Note that revisions to employment affect GDP per worker and GDP per hour worked series.

Average hours worked data – labour input data on hours are also updated in the autumn release and only affect GDP per hour worked. Compared with employment estimates, hours estimates are subject to higher frequency of methodological revisions. This reflects the inherent difficulties in measuring hours and in ensuring cross-country comparability

Comparability and coherence

(Comparability is the degree to which data can be compared over time and domain, for example, geographic level. Coherence is the degree to which data that are derived from different sources or methods, but refer to the same topic, are similar.)

Comparability and coherence of sources

GDP data

All G7 countries follow the UN System of National Accounts: SNA93 and are in the process of [implementing SNA08](#). However, problems can arise because of differences in the concepts and measurement practice across countries. The [ONS productivity handbook](#) Chapter 12 highlights which components of GDP are treated differently across countries.

Labour input data

Total employment inputs taken from the OECD website are based on each country's own LFS. The OECD adjusts all labour force data it receives from individual countries to produce the greatest level of consistency across surveys. Compared with most other statistical sources on employment, Labour Force Surveys are quite well standardised across OECD countries.

However, in the [OECD Employment outlook](#), hours worked are calculated according to both national accounts and Labour Force Survey concepts, depending on the country. The OECD adjusts the data it receives from individual countries to produce the greatest level of consistency. Nevertheless, work remains to be done to improve the international comparability of hours worked measures, because of differences arising from employment concepts, survey concepts and design as well as exclusions or inclusions of certain activities, for example, meal breaks.

Comparability and coherence of results

ONS labour productivity estimates

The [Labour productivity statistical bulletin](#) is published quarterly, providing more timely and detailed measures of UK productivity. Although the Labour productivity bulletin uses gross value added (GVA), not GDP, (see the How the output is created section) the output measures should be equal at the whole economy level producing similar results to the ICP statistical bulletin.

OECD productivity estimates

The [OECD publishes GDP per hour worked](#) for various countries. The differences between the ONS ICP series and OECD series are not large and can be explained by the different sources. In particular, ONS estimates use employment data based on countries' Labour Force Surveys, whereas the OECD uses that based on the national accounts. Furthermore the OECD uses the annual national accounts, whereas ONS uses the quarterly national accounts for GDP data. Both sets of productivity measures are constructed with a view to maximising comparability and consistency across countries.

Multi-factor productivity

[Multi-factor productivity \(MFP\)](#) and other growth accounting analysis aim to identify the contribution of various sources of productivity growth including labour and capital. The labour input used in MFP developed is called [Quality-adjusted labour input \(QALI\)](#). QALI is considered to be an improved measure of labour's input into production as it explicitly accounts for variations in the skill level of the workforce over time. ICP does not adjust for labour quality. [The Conference Board](#) publishes total factor productivity estimates for various countries.

KLEMS

The [EU KLEMS](#) project was led by the University of Groningen and the National Institute of Economic and Social Research (NIESR) on behalf of the European Commission. Its purpose was to create a database on productivity by industry for EU member states with a breakdown into contributions from capital (K), labour (L), energy (E), materials (M) and business services (S).

KLEMS productivity estimates are multi-factor total output productivity and allow for detailed comparisons to be made across countries. Its estimates differ from ICP in that the inputs used are broader and the productivity analysis is for individual industries, whereas ICP analysis is at the whole economy level.

9 . Concepts and definitions

(Concepts and definitions describe the legislation governing the output and a description of the classifications used in the output.)

International comparisons of productivity (ICP) estimates were first introduced in January 1998, when they were compiled by the Department for Trade and Industry (now BEIS). Responsibility for production of [ICP transferred to ONS](#) in 2001. Until 2010, ICP was an explicit indicator in a public service agreement (PSA) between HM Treasury and the Department for Business, Energy and Regulatory Reform (now BEIS) to [Raise the productivity of the UK economy](#). All PSAs were abolished by the Coalition government in 2010.

In light of this, we considered whether to continue producing ICP as part of the consultation on our statistical work programme in 2010 to 2011. The decision was to continue publication, in part due to the very low costs involved.

Labour productivity estimates are derived statistics, meaning they use other published data. The [UK National Accounts](#) output data are governed by the conventions of the European System of Accounts 1995: ESA 1995.

The definitions and concepts of the Labour Productivity statistics are compliant with relevant sections of the [Measuring Productivity OECD Manual](#) and the [ONS productivity handbook](#).

10 . Other information

Output quality trade-offs

(Trade-offs are the extent to which different dimensions of quality are balanced against each other.)

As stated in the Timeliness and punctuality section, international comparisons of productivity (ICP) estimates are derived statistics. This means that the quality, timing and extent to which revisions occur is largely dependent upon the source data, most of which are sourced outside of ONS. The most notable trade-off relates to French employment data (see the How the output is created section). The autumn edition of ICP is published with an estimate from [Eurostat](#), on which the final data are based. Thus, because any difference between these sources is small, using a proxy gives the best value for users, providing more timely estimates. The Validation and quality assurance section gives more information on the characteristics of each source.

Uses and limitations of international comparisons of productivity statistics

ICP measures show estimated levels of economic output per unit of labour input across the countries covered by the analysis. In interpreting these statistics, you should keep the following points in mind.

ICP level statistics (Tables 1 and 2 in each [ICP statistical bulletin](#)) provide an indication of relative labour productivity at a point in time.

ICP level statistics are presented in an index form. As such, inferences cannot be made about changes to the underlying level measures from which the statistics are produced. That is to say, if the relative levels of productivity between two countries change between periods, the composition of the change between the two countries cannot be derived.

The absolute performance of an individual country through time cannot be determined from the levels.

ICP time series statistics (Tables 3 and 4 in each [ICP statistical bulletin](#)) show the growth of real (inflation adjusted) value added in each country over a period of time.

ICP time series statistics are presented in an index form. Hence, if the index for one country is higher than that of another country, then this does not imply that productivity is higher, but that productivity has grown more since the index year.

The output measure used in ICP measures is gross domestic product (GDP). This differs from that used in the Labour productivity statistical bulletin (gross value added (GVA)) because of the need to use PPPs to calculate internationally comparable volume output measures.

PPPs are only estimates and may not fully reflect structural differences between economies, for example, the size and composition of government services. For more information on the use and limitations of PPPs, see [International Comparisons of Productivity: the current and constant PPP approach](#).

ICP estimates cover labour productivity only. It should be noted that international differences in output per unit of labour input may reflect differences in infrastructure, the supply of capital, resource endowments and so on.

Since labour productivity is an important factor in determining living standards, estimates also give some information on relative living standards.

Assessment of user needs and perceptions

(The processes for finding out about users and uses, and their views on the statistical products.)

The ONS Productivity Development Branch is responsible for producing ICP statistics and can be contacted via the productivity mailbox (productivity@ons.gsi.gov.uk). A user group list, created through such correspondence, enables a clear means of engagement with a variety of users, for example, increasing participation in the ONS Work Programme consultation in November 2010.

Reviewing communication from users sent to the productivity inbox regarding ICP, there have been requests for additional data, such as more countries to be included in the comparisons and detail by industry. Other enquiries include clarification on why a series has behaved in a particular way, why an estimate has changed from a previously published value and on the future timing of productivity releases.

As part of our user engagement strategy and at the behest of identified users, we held a productivity statistics user group workshop in February 2012. The aims of this workshop were to re-launch the user group, to discuss recent developments in productivity measurements, gauge user requirements and establish a generally accepted medium and frequency for user engagement.

11 . Sources for further information or advice

Accessibility and clarity

(Accessibility is the ease with which users are able to access the data, also reflecting the format in which the data are available and the availability of supporting information. Clarity refers to the quality and sufficiency of the release details, illustrations and accompanying advice.)

The ICP series are published in the [ICP statistical bulletin](#), which along with the data are available to download free of charge. The source data are also freely available on the OECD website. The [ONS productivity handbook](#) provides information on how all productivity measures are sourced and formulated.

Further information and analysis can be obtained from the Productivity Team by phoning +44 (0)1633 651837 or emailing productivity@ons.gov.uk.

Our recommended format for accessible content is a combination of HTML webpages for narrative, charts and graphs, with data being provided in usable formats such as CSV and Excel. Our website also offers users the option to download the narrative in PDF format. In some instances other software may be used, or may be available on request. Available formats for content published on our website but not produced by us, or referenced on our website but stored elsewhere, may vary. For further information please refer to the contact details at the beginning of this report.

For information regarding conditions of access to data, please refer to the following links:

- [Terms and conditions](#) (for data on the website)
- [Copyright and reuse of published data](#)
- [Pre-release access](#) (ended from 1 July 2017)
- [Accessibility](#)
- Access to microdata via the [Virtual Microdata Laboratory](#)

In addition to this Quality and Methodology Information report, basic quality information relevant to each release is available in the quality and methodology section of the relevant statistical bulletin. These and other methodology notes are available on the [productivity measures webpage](#).